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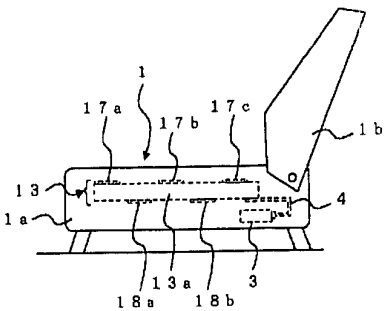
(54)【発明の名称】　乗員検知システムおよびそれを使用した乗員検知方法

(57)【要約】
【課題】電界式乗員検知センサの水濡れによる影響と人体との切り分けを行い、より精度の高い乗員判定が可能な乗員検知システムを提供する。
【解決手段】シート１と、絶縁板１３ａの上下面に間隔一定でに互い違いに配置された上電極（１７ａ，１７ｂ，１７ｃ）および下電極（１８ａ，１８ｂ）電極を有する電界式乗員検知センサ１３と、上電極および下電極に微弱電界を発生させるための発振回路と上電極および下電極に流れる負荷電流を検出する電流検出回路と微弱電界に基づいて流れる電位電流を電圧に変換する電流・電圧変換回路と電流検出回路および電流・電圧変換回路出力信号に基づいてシート１への乗員などの着席状況を検知する制御回路とを有する検知ユニット３とを具備した乗員検知システム。



1：シート
1a：着席部
1b：背もたれ部
3：検知ユニット
4：シールド線
13：電界式乗員検知センサ
13a：絶縁板
17a～17c：上電極
18a，18b：下電極

【特許請求の範囲】

【請求項１】　シートと、所定の厚さの絶縁板の上下それぞれの面に電極間隔が一定になるように互い違いに配置された同じ幅の複数の第１の電極および第２の電極を有し、前記シート内部に前記絶縁板が水平になるように配置された電界式乗員検知センサと、前記第1の電極および前記第２の電極に微弱電界を発生させるための発振回路と該発振回路から前記第1および第２の電極に流れる負荷電流を検出する電流検出回路と前記微弱電界に基づいて流れる電位電流を検出し、電圧に変換する電流・電圧変換回路と前記電流検出回路および前記電流・電圧変換回路出力信号に基づいてシートへの乗員などの着席状況を検知する制御回路とを有する検知ユニットとを具備したことを特徴とする乗員検知システム。

【請求項２】　シートと、所定の厚さの絶縁板の上下それぞれの面に電極間隔が一定になるように互い違いに配置された同じ幅の複数の第１の電極および第２の電極を有し、前記シート内部に前記絶縁板が水平になるように配置された電界式乗員検知センサと、前記シートの内部および／または下部に設けられ、前記シートに着席する乗員の重量を検出する重量センサと、前記第１の電極および前記第２の電極に微弱電界を発生させるための発振回路と該発振回路から前記第1および第２の電極に流れる負荷電流を検出する電流検出回路と前記微弱電界に基づいて流れる電位電流を検出し、電圧に変換する電流・電圧変換回路と前記電流検出回路、前記電流・電圧変換回路および前記重量センサの出力信号に基づいてシートへの乗員などの着席状況を検知する制御回路とを有する検知ユニットとを具備したことを特徴とする乗員検知システム。

【請求項３】　シートと、所定の厚さの絶縁板の上下それぞれの面に電極間隔が一定になるように互い違いに配置された同じ幅の複数の第１の電極および第２の電極と前記第１の電極直下の前記絶縁板の前記下面に厚みセンサとを有し、前記シート内部に前記絶縁板が水平になるように配置された電界式乗員検知センサと、前記第１の電極および前記第２の電極に微弱電界を発生させるための発振回路と該発振回路から前記第1および第２の電極に流れる負荷電流を検出する電流検出回路と前記微弱電界に基づいて流れる電位電流を検出し、電圧に変換する電流・電圧変換回路と前記電流検出回路、前記電流・電圧変換回路および前記厚みセンサの出力信号に基づいてシートへの乗員などの着席状況を検知する制御回路とを有する検知ユニットとを具備したことを特徴とする乗員検知システム。

【請求項４】　シートと、所定の厚さの絶縁板の上下それぞれの面に電極間隔が一定になるように互い違いに配置された同じ幅の複数の第１の電極および第２の電極と前記第１の電極直下の前記絶縁板の前記下面に厚みセンサとを有し、前記シート内部に前記絶縁板が水平になるように配置された電界式乗員検知センサと、前記シートの内部および／または下部に設けられ、前記シートに着席する乗員の重量を検出する重量センサと、前記第１の電極および前記第２の電極に微弱電界を発生させるための発振回路と該発振回路から前記第1および第２の電極に流れる負荷電流を検出する電流検出回路と前記微弱電界に基づいて流れる電位電流を検出し、電圧に変換する電流・電圧変換回路と前記電流検出回路、前記電流・電圧変換回路、前記厚みセンサおよび前記重量センサの出力信号に基づいてシートへの乗員などの着席状況を検知する制御回路とを有する検知ユニットとを具備したことを特徴とする乗員検知システム。

【請求項５】　前記シートの内部に設けられる前記重量センサがマット式の第１の重量センサからなることを特徴とする請求項２または４記載の乗員検知システム。

【請求項６】　前記シートの下部に設けられる前記重量センサが前記シートの足部に設けられた歪ゲージ式の第２の重量センサからなることを特徴とする請求項２または４記載の乗員検知システム。

【請求項７】　前記シートの下部に設けられる前記重量センサが前記シート全体が載置され、該シート全体と該シート上に負荷される物体の重量が測定できる第３の重量センサからなることを特徴とする請求項２または４記載の乗員検知システム。

【請求項８】　前記シートの下部に設けられる前記重量センサが請求項６記載の前記第２の重量センサと、請求項７記載の第３の重量センサから構成されることを特徴とする請求項２または４記載の乗員検知システム。

【請求項９】　前記第１の電極および前記第２の電極が矩形状であることを特徴とする請求項１～４のいずれかに記載の乗員検知システム。

【請求項１０】　前記第１の電極がヒダ状であることを特徴とする請求項１～４のいずれかに記載の乗員検知システム。

【請求項１１】　前記電界式乗員検知センサの前記絶縁板として柔弾性樹脂を使用したことを特徴とする請求項３または４に記載の乗員検知システム。

【請求項１２】　請求項１～４のいずれかに記載の乗員検知システムを使用した乗員検知方法であって、隣接する前記第１の電極と前記第２の電極の３枚の占めるエリアを一区分として、前記微弱電界を発生する前記第１の電極から出力され前記電流・電圧変換回路によって変換された直流電流の大きさの平均値をＴ、前記微弱電界を発生する前記第２の電極から出力され前記電流・電圧変換回路によって変換された直流電流の大きさの平均値をＢとして、下式（１）および（２）によって定義される前記シート上の物体の大きさを表す演算値Ａと前記シート上の該物体と前記電界式乗員検知センサとの距離を表す演算値Ｒを各区分毎に計算し、演算値Ａの最大値Ａｍａｘと演算値Ａの平均値Ａａｖｅの関係または演算値Ａ

の最大値Ａｍａｘと演算値Ｒの最大値Ｒｍａｘの関係を予め前記制御回路に記憶されているしきい値と比較して前記シートへの乗員の着座有無と乗員の大人・子供の判別を行うことを特徴とする乗員検知方法。

【数１】

$$A = \frac{T * B}{(T-B)} * B^{-y} \quad (1)$$

$$R = \frac{A * Z}{T} \quad (2)$$

但し、ｙ：定数，Ｚ：定数

【請求項１３】　請求項１３記載の乗員検知方法において、さらに前記電界式乗員検知センサの前記第1の電極および前記第２の電極の対地インピーダンスの変動の大きさを比較して前記シートへの水分進入の有無と前記シートへの乗員の着座有無と乗員の大人・子供の判別を行うことを特徴とする乗員検知方法。

【請求項１４】　請求項２記載の乗員検知システムを使用した乗員検知方法であって、前記シートの内部および／または下部に設けられた前記重量センサの出力の大きさおよび前記電界式乗員検知センサの前記第1の電極および前記第２の電極の対地インピーダンスの変動の大きさを比較して前記シートへの乗員の着座有無および前記シートへの水分進入の有無を判別することを特徴とする乗員検知方法。

【請求項１５】　請求項３記載の乗員検知システムを使用した乗員検知方法であって、前記厚みセンサの出力の大きさおよび前記電界式乗員検知センサの前記第1の電極および前記第２の電極の対地インピーダンスの変動の大きさを比較して前記シートへの乗員の着座有無および前記シートへの水分進入の有無を判別することを特徴とする乗員検知方法。

【請求項１６】　請求項４記載の乗員検知システムを使用した乗員検知方法であって、前記厚みセンサの出力の大きさ、前記シートの内部および／または下部に設けられた前記重量センサの出力の大きさおよび前記電界式乗員検知センサの前記第1の電極および前記第２の電極の対地インピーダンスの変動の大きさを比較して前記シートへの乗員の着座有無および前記シートへの水分進入の有無を判別することを特徴とする乗員検知方法。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】この発明は乗員検知システムに関し、特にエアバッグ装置を搭載した車両シートにおける乗員の着席状況に応じてエアバッグ装置のエアバッグを展開可能な状態又は展開不可能な状態に設定するために使用される乗員検知システムの精度向上に関する。

【０００２】

【従来の技術】自動車の衝突時に乗員が受ける衝撃を緩和するエアバッグ装置は、シートへの乗員の着席の有無に関係なく、自動車が衝突するとエアバッグが展開するようになっているのが通常である。このようなエアバッグ装置は、シートに大人が正常な姿勢で着席している場合には自動車の衝突時に乗員の保護効果が期待できるのであるが、シートに着席している乗員が子供などであって、着席姿勢がエアバッグ展開に不適当な場合においては、仮に自動車が衝突してもエアバッグを展開させないことが望ましい。

【０００３】そこで、エアバッグ装置を搭載した自動車のシートへの乗員の着席の有無や、シートに着席した乗員が大人か子供か、或いは、シートに着席した乗員の姿勢などの着席状況を検知する乗員検知システムが特開平１０－２３６２６９号公報、特開平１１－３３４４５１号公報等に提案されている。この乗員検知システムの一例を、図１０のシート構造と図１１の乗員検知回路ブロックを参照して説明する。図１０（ａ）はシートの側面図であり、図１０（ｂ）はシートの着席部からみた正面図である。図１０中、符号１はシートを示す。このシート１は着席部１ａと背もたれ部１ｂで構成される。着席部１ａと背もたれ部１ｂは図示しない支持枠，クッション材，クッション材を被覆する外装材で構成される。図１０のシート１においては、例えば背もたれ部１ｂの外装材とクッション材との間に複数のアンテナ電極２が配置され、着席部１ａの近傍に検知ユニット３が設置されている。各アンテナ電極２と検知ユニット３はシールド線４で配線される。特に、アンテナ電極２は、例えば矩形状の導電体で構成されている。尚、複数のアンテナ電極２は背もたれ部１ｂに水平状態で縦方向に配列することもできる。

【０００４】検知ユニット３はアンテナ電極２の周辺に発生させた微弱電界によって流れる電流に関連する情報に基づいてシート１における乗員の着席状況を検知するものである。乗員検知システムの回路ブロック図を図１１に示す。検知ユニット３は、例えば周波数が１２０ＫＨｚ程度で電圧が数～１０Ｖ程度の高周波低電圧を発生し、アンテナ電極２の周辺に微弱電界を発生させるための電界発生手段（例えば発振回路５）と、発振回路５からの送信信号に基づいてアンテナ電極２に流れる電流に関連する情報を検出する情報検出回路（例えば電流検出回路６）と、発振回路５の送信信号を各アンテナ電極２に順に送信する複数のスイッチング素子７と、電流検出回路６で検出された電流を直流に変換するＡＣ－ＤＣ変換回路８と、その変換信号を必要に応じて増幅する増幅回路９と、ＣＰＵ，Ａ／Ｄ変換部，外部メモリ（例えばＥＥＰＲＯＭ，ＲＡＭ）などを含む制御回路１０と、図示しない電源回路とから構成されている。この検知ユニット３において、複数のスイッチング素子７は制御回路１０からの信号に基づいてオン・オフ制御される。そして、各スイッチング素子７はコネクタ１１を介して各アンテナ電極２とシールド線４によって接続されている。

制御回路１０はエアバック装置１２に接続されており、エアバック装置１２を後述するように制御する。

【０００５】発振回路５からの送信信号は電流検出回路６を介してスイッチング素子７に送信され、特定のスイッチング素子７がオンすると対応するシールド線４を介して特定のアンテナ電極２に印加され、特定のアンテナ電極２の周辺に微弱電界を発生させる。微弱電界が発生したアンテナ電極２にはシート１への乗員の着席状況に応じた電流が流れる。この電流は電流検出回路６で検出される。複数のスイッチング素子７が順にオン・オフ制御されることによって、各アンテナ電極２に流れる電流が次々と検出される。これらの検出電流はＡＣ－ＤＣ変換回路８にて直流に変換され、増幅回路９にて増幅されて制御回路１０に取り込まれる。

【０００６】制御回路１０には、予め乗員の着席状況の判断基準となるしきい値データ，信号パターンデータなどが記憶されており、制御回路１０に取り込まれ、演算処理された現実の信号データはしきい値データと比較され、シート１への乗員の着席状況（着席の有無，乗員が大人か子供かなど）が判断される。この判断結果は制御回路１０からエアバッグ装置１２に送信され、エアバッグ装置１２のエアバッグは展開可能な状態又は展開不可能な状態にセットされる。

【０００７】

【発明が解決しようとする課題】上記のような各電極が同一平面上に構成されるアンテナ電極２のセンサを使用した従来の乗員検知システムにおいては、例えば大きな人がシート上に座布団を敷いて座っている状態と、小さな人がシート上に座布団を敷かずに直接座っている状態では同じレベルに検知される。また、人の着衣の厚さによる検知感度への影響を回避できなかった。また、人体の持つ比誘電率が他の物体と大きく異なることを特徴とした電界式乗員検知システムであるため、外装材、及び複数のアンテナ電極２の間を構成する部品に人体に近い比誘電率を有する水分が進入した場合、水分と人の影響の切り分けができなかった。

【０００８】従って、本発明の目的は、シート上の座布団有無の影響がなく、水分の進入と人体との判別を行え、しかも十分な乗員検知精度を期待できる乗員検知システムを提供することにある。

【０００９】

【課題を解決するための手段】本発明の第１の構成は、乗員検知システムであって、シートと、所定の厚さの絶縁板の上下それぞれの面に電極間隔が一定になるように互い違いに配置された同じ幅の複数の第１の電極および第２の電極を有し、前記シート内部に前記絶縁板が水平になるように配置された電界式乗員検知センサと、前記シートの内部および／または下部に設けられ、前記シートに着席する乗員の重量を検出する重量センサと、前記第１の電極および前記第２の電極に微弱電界を発生させるための発振回路と該発振回路から前記第1および第２の電極に流れる負荷電流を検出する電流検出回路と前記微弱電界に基づいて流れる電位電流を検出し、電圧に変換する電流・電圧変換回路と前記電流検出回路および前記電流・電圧変換回路出力信号に基づいてシートへの乗員などの着席状況を検知する制御回路とを有する検知ユニットとを具備したことを特徴とする。

【００１０】本発明の第２の構成は、乗員検知システムであって、シートと、所定の厚さの絶縁板の上下それぞれの面に電極間隔が一定になるように互い違いに配置された同じ幅の複数の第１の電極および第２の電極を有し、前記シート内部に前記絶縁板が水平になるように配置された電界式乗員検知センサと、前記シートの内部および／または下部に設けられ、前記シートに着席する乗員の重量を検出する重量センサと、前記第１の電極および前記第２の電極に微弱電界を発生させるための発振回路と該発振回路から前記第1および第２の電極に流れる負荷電流を検出する電流検出回路と前記微弱電界に基づいて流れる電位電流を検出し、電圧に変換する電流・電圧変換回路と前記電流検出回路、前記電流・電圧変換回路および前記重量センサの出力信号に基づいてシートへの乗員などの着席状況を検知する制御回路とを有する検知ユニットとを具備したことを特徴とする。

【００１１】本発明の第３の構成は、乗員検知システムであって、シートと、所定の厚さの絶縁板の上下それぞれの面に電極間隔が一定になるように互い違いに配置された同じ幅の複数の第１の電極および第２の電極と前記第１の電極直下の前記絶縁板の前記下面に厚みセンサとを有し、前記シート内部に前記絶縁板が水平になるように配置された電界式乗員検知センサと、前記第１の電極および前記第２の電極に微弱電界を発生させるための発振回路と該発振回路から前記第1および第２の電極に流れる負荷電流を検出する電流検出回路と前記微弱電界に基づいて流れる電位電流を検出し、電圧に変換する電流・電圧変換回路と前記電流検出回路、前記電流・電圧変換回路および前記厚みセンサの出力信号に基づいてシートへの乗員などの着席状況を検知する制御回路とを有する検知ユニットとを具備したことを特徴とする。

【００１２】本発明の第４の構成は、乗員検知システムであって、シートと、所定の厚さの絶縁板の上下それぞれの面に電極間隔が一定になるように互い違いに配置された同じ幅の複数の第１の電極および第２の電極と前記第１の電極直下の前記絶縁板の前記下面に厚みセンサとを有し、前記シート内部に前記絶縁板が水平になるように配置された電界式乗員検知センサと、前記シートの内部および／または下部に設けられ、前記シートに着席する乗員の重量を検出する重量センサと、前記第１の電極および前記第２の電極に微弱電界を発生させるための発振回路と該発振回路から前記第1および第２の電極に流れる負荷電流を検出する電流検出回路と前記微弱電界に基づいて流れる電位電流を検出し、電圧に変換する電流・電圧変換回路と前記電流検出回路、前記電流・電圧変

換回路、前記厚みセンサおよび前記重量センサの出力信号に基づいてシートへの乗員などの着席状況を検知する制御回路とを有する検知ユニットとを具備したことを特徴とする。

【００１３】上記の本発明の第１～第４の構成の乗員検知システムにおける前記電界式センサの前記第1の電極として矩形またはヒダ状の電極を使用することができる。

【００１４】上記の本発明の第２および第４の構成の乗員検知システムにおいて、前記シートの内部に設けられる前記重量センサとしてはマット式重量センサを使用することができる。また、前記シートの下部に設けられる前記重量センサとしては記シートの足部に設けられた歪ゲージ式重量センサ前記シート全体が載置され、該シート全体の重量が測定できる重量センサを使用することができる。

【００１５】本発明の第５の構成は、上記の第１～第４のいずれかの構成の乗員検知システムを使用した乗員検知方法であって、請求項１～４のいずれかに記載の乗員検知システムを使用した乗員検知方法であって、隣接する前記第１の電極と前記第２の電極の３枚の占めるエリアを一区分として、前記微弱電界を発生する前記第１の電極から出力され前記電流・電圧変換回路によって変換された直流電流の大きさの平均値をT、前記微弱電界を発生する前記第２の電極から出力され前記電流・電圧変換回路によって変換された直流電流の大きさの平均値をBとして、下式（１）および（２）によって定義される前記シート上の物体の大きさを表す演算値Aと前記シート上の該物体と前記電界式乗員検知センサとの距離を表す演算値Rを各区分毎に計算し、演算値Aの最大値Amaxと演算値Aの平均値Ａａｖｅの関係または演算値Aの最大値Amaxと演算値Rの最大値Rmaxの関係を予め前記制御回路に記憶されているしきい値と比較して前記シートへの乗員の着座有無と乗員の大人・子供の判定を行うことを特徴とする。

【００１６】

【数２】

$$A = \frac{T * B}{(T-B)} * B^{-\gamma} \quad (1)$$

$$R = \frac{A * Z}{T} \quad (2)$$

但し、γ：定数，Z：定数

【００１７】本発明の第６の構成は、上記の第１～第４の構成の乗員検知システムを使用した乗員検知方法であって、上記の第５の構成の乗員検知方法にさらに前記第1の電極および前記第２の電極の対地インピーダンスの変動の大きさを検知し、前記シートへの水分進入の有無、前記シートへの乗員座席の有無および大人と子供の判別を行うことを特徴とする。

【００１８】本発明の第７の構成は、上記の第２の構成の乗員検知システムを使用した乗員検知方法であって、前記シートの内部および／または下部に設けられた前記重量センサの出力の大きさおよび前記電界式乗員検知センサの前記第1の電極および前記第２の電極の対地インピーダンスの変動の大きさを比較して前記シートへの乗員の着座有無および前記シートへの水分進入の有無を判別することを特徴とする。

【００１９】本発明の第８の構成は、上記の第３の構成の乗員検知システムを使用した乗員検知方法であって、前記厚みセンサの出力の大きさおよび前記電界式乗員検知センサの前記第1の電極および前記第２の電極の対地インピーダンスの変動の大きさを比較して前記シートへの乗員の着座有無および前記シートへの水分進入の有無を判別することを特徴とする。

【００２０】本発明の第９の構成は、上記の第４の構成の乗員検知システムを使用した乗員検知方法であって、前記厚みセンサの出力の大きさ、前記シートの内部および／または下部に設けられた前記重量センサの出力の大きさおよび前記電界式乗員検知センサの前記第1の電極および前記第２の電極の対地インピーダンスの変動の大きさを比較して前記シートへの乗員の着座有無および前記シートへの水分進入の有無を判別することを特徴とする。

【００２１】

【発明の実施の形態】次に、本発明の実施の形態の乗員検知システムについて図面を参照にして詳細に説明する。

【００２２】図１は、本発明の第１の実施の形態の乗員検知システムの側面図である。図１のように、本実施の形態の乗員検知システムは、シート１と、所定の厚さの絶縁板１３ａの上下それぞれの面に電極間隔が一定になるように互い違いに配置された同じ幅の複数の上電極１７ａ，１７ｂ，１７ｃ（第１の電極）および下電極１８ａ，１８ｂ（第２の電極）を有し、シート１内部に該絶縁板が水平になるように配置された電界式乗員検知センサ１３と、上電極１７間および／または下電極１８間に微弱電界を発生させるための発振回路と該発振回路から上電極１７ａ，１７ｂ，１７ｃおよび下電極１８ａ，１８ｂの電極に流れる負荷電流を検出する電流検出回路と上電極１７ａ，１７ｂ，１７ｃ、下電極１８ａ，１８ｂの微弱電界に基づいて流れる電位電流を検出し、電圧に変換する電流・電圧変換回路と電流検出回路および電流・電圧変換回路出力信号に基づいてシートへの乗員などの着席状況を検知する制御回路とを有する検知ユニット３とを具備している。

【００２３】検知ユニット３はシールド線４を介して電界式乗員検知センサ１３に接続されている。なお図１中符号１ｂは背もたれ部を示す。

【００２４】図２は図１の電界式乗員検知センサ１３の

平面図（図２（ａ））および断面図（図２（ｂ））である。絶縁板１３ａとしてはエポキシ樹脂、ポリイミド樹脂やポリウレタン樹脂等の絶縁板を使用することができる。電界式乗員検知センサ１３の上電極および下電極は銅箔をエッチングして形成される。これらの電極の表面にはニッケルめっきと金めっき等により耐食処理を施すことが望ましい。図２のように電界式乗員検知センサ１３の上下電極は互い違いにずらして配置しているのは、上下電極の干渉を防止するためである。

【００２５】なお、上電極の形状としては図２のような矩形状電極や図３のようなヒダ状電極２０を使用することができる。図３のヒダ状電極２０の場合には、電極側面の面積が増加し、電極間に吸着した水分による電極間の絶縁性への影響感度を向上することができる。

【００２６】図８は図１の乗員検知システムの回路ブロック図である。図中、検知ユニット３部の符号５は発振回路、６は電流検出回路、７ａ～７ｅはスイッチング手段、８はＡＣ－ＤＣ変換回路、９は増幅回路、１０は制御回路、符号１１は電界式乗員検知センサ１３の上電極１７ａ，１７ｂ，１７ｃおよび下電極１８ａ，１８ｂをシール線４によって検知ユニットに接続するための検知ユニットに設けられたコネクタである。また符号１２は制御回路に接続されてその動作（展開、非展開）が制御されるエアバッグ装置を示す。

【００２７】次に、この乗員検知システムの動作について図１および図８を参照して説明する。まず、制御回路１０からの信号に基づきスイッチング手段７ａのみが閉成され、その他のスイッチング手段７ｂ～７ｅは開成される。このために、電界発生手段の発振回路５のスイッチング手段（表示していない）にはゲート信号が付与される。ゲート信号がハイ（Ｈｉｇｈ）になると、その都度、発振回路５のスイッチング手段はオンとなり、それのドレインが接地レベルとなり、送信系には出力されない。尚、この際に、上電極１７ａの周辺に存在するキャパシタンス成分に充電された電荷が発振回路５のスイッチング手段を介して放電される。

【００２８】一方、ゲート信号がロウ（Ｌｏｗ）となると、発振回路５のスイッチング手段はオフとなり、送信系に高周波低電圧（例えば１２０ＫＨｚ，＋５Ｖ）が出力される。この高周波出力は送信系，コネクタ１１を介して上電極１７ａに供給され、上電極１７ａの周辺に微弱電界が発生される。その結果、シート１への乗員の着席の有無，乗員の識別（大人か子供かの区別）などの着席状況に応じて異なったレベルの電流が流れる。

【００２９】このように発振回路５（電界発生手段）を含む送信系，上電極１７ａの高周波低電圧（電圧波形）は電流検出回路６においてインピーダンス変換される。即ち、入力側は高インピーダンス、出力側（ＡＣ－ＤＣ変換回路８側）は低インピーダンスとなり、制御回路１０の読み込みに要する電流を必要に応じて適宜に取り込むことが可能となる。

【００３０】電流検出回路６の出力（高周波低電圧）はＡＣ－ＤＣ変換回路８に入力される。この回路８では、交流のライン電圧は抵抗とコンデンサとを含む平滑回路によって平滑され、直流に変換される。このＡＣ－ＤＣ変換回路８の直流出力は増幅回路９を経由して制御回路１０に取り込まれ、Ａ／Ｄ変換され、メモリに格納される。そして、スイッチング手段７ａからスイッチング手段７ｂ・・・スイッチング手段７ｅに切り換えられる毎に、それぞれの電極部（上電極１７ｂ，１７ｃ、下電極１８ａ，１８ｂ）に関連する信号がそれぞれのインターフェース回路から出力され、制御回路１０に次々と取り込まれる。

【００３１】今隣接する上下電極３枚（例えば上電極１７ａ，下電極１８ａ，上電極１７ｂ）のエリアの上電極の出力値（平均）をT、下電極の出力値（平均）をBとしてエリアの大きさの演算値Aと距離演算値Rを次式（１）、（２）から計算する。

【００３２】

【数３】

$$A = \frac{T * B}{(T-B)} * B^{-\gamma} \quad (1)$$

$$R = \frac{A * Z}{T} \quad (2)$$

但し、γ：定数，Z：定数

【００３３】各電極の出力値は大人は大きく、子供は小さくなる傾向がある。また、同じ大きさの物体でもセンサとの距離が近い場合は大きく、遠い場合は小さくなる。この傾向を利用し、各エリアのAの値の最大値Amaxと平均値Ａａｖｅの比較、各エリアのAの値の最大値Amaxと各エリアの距離演算値Rの最大値Rmaxをそれぞれ判断基準となるしきい値データ（予め制御回路１に記憶されている）と比較して大人と子供を判別する。

【００３４】上記の第１の実施の形態の乗員検知システムでは、電界式乗員検知センサ１３の上電極１７ａ，１７ｂ，１７ｃと下電極１８ａ，１８ｂの対地インピーダンスの大きさを測定することによってシートへの水の進入の有無を判定することができる。水が進入すると下電極と比較して上電極の対地インピーダンスが大きく変動するために水溜れがわかる。

【００３５】なお、上記の最大値Amaxと平均値Ａａｖｅの関係、最大値Amaxと最大値Rmax関係の制御回路に予め記憶されているしきい値データと比較して図８に示すエアバッグ装置１２の展開または非展開可能状態にすることが決定される。

【００３６】次に本発明の第２の実施の形態の乗員検知システムについて図面を参照して説明する。図４は本発明の第２の実施の形態の乗員検知システムの側面図であ

る，図４で図１と同じ符号は図１と同じものを表す。

【００３７】本実施の形態の乗員検知システムは、上記の本発明の第１の実施の形態の乗員検知システムに、さらに重量センサを付加したものである。図４においては重量センサはシート内部の電界式乗員検知センサ１３の上に設けられた例えばマット式重量センサの第１の重量センサ１４、シート全体の重量を検知する重量センサの第２の重量センサ１５、シート１の足部分の歪みにより重量を検知する歪みゲージ式重量センサの第３の重量センサ１６の３種類設けられているが、これらの１種類または２種類の重量センサを使用してもよい。電界式乗員検知センサ１３はシールド線４を介して検知ユニット３に接続される。また、各重量センサも検知ユニット３に接続される。図９は図４の乗員検知システムの回路ブロック図である。図９のように各重量センサは検知ユニット３の制御回路１０に接続され、重量センサの出力信号を検知するようになっている。

【００３８】本実施の形態の乗員検知システムの検知ユニット３と電界式乗員検知センサ１３は上記の第１の実施の形態と同様な動作をする。さらに本実施の形態では重量センサを図４のように設置することによりシートへの水の進入を検知することができる。重量センサが物体を検知した場合には、上記の第１の実施の形態と同様にエリアの大きさの演算値Ａの最大値Ａｍａｘと平均値Ａａｖｅの関係と、エリアの大きさの演算値Ａの最大値Ａｍａｘと距離演算値Ｒの最大値Ｒｍａｘの関係をそれぞれ予め制御回路１０に記憶されている判断基準となるしきい値データと比較して大人と子供の判別する。

【００３９】本実施の形態の乗員検知システムでは、水により濡れた場合で、かつ座席に物体が乗っていない場合、電界式乗員検知センサ１３は水分を検知するが、重量センサ１４，１５，１６はいずれも水分の影響を受けないため、物体としては検知しない。この条件に当てはまる場合は水濡れ状態と判定される。電界式乗員検知センサ１３は水分の検知方法は、上記の第１の実施の形態で説明したと同様に電界式乗員検知センサ１３の上電極と下電極の対地インピーダンスを測定することにより行うことができる。

【００４０】次に本発明の第３の実施の形態の乗員検知システムについて図面を参照して説明する。図５は本発明の第３の実施の形態の乗員検知システムの側面図であり図６は電界式乗員検知センサの平面図（図６（ａ））と断面図（図６（ｂ））である。

【００４１】本実施の形態の実施例の乗員検知システムは、上記の本発明の第１の実施の形態の乗員検知システムの電界式乗員検知センサ１３の各々の上電極１７ａ，１７ｂ，１７ｃ直下の絶縁板１３ａの下面に、さらに厚みセンサ１９を付加したものである。この厚みセンサ１９は図７に示した同様な検知ユニットの制御回路１０に接続され、厚みセンサ１９の出力信号を検知するようになっている。

【００４２】電界式乗員検知センサ１３の絶縁板１３ａにはポリウレタン等の柔弾性樹脂を使用する。この柔弾性樹脂からなる絶縁板１３ａは上から重みがかかると薄くなり上電極が厚みセンサ１９に近づき厚みセンサ１９は上から重みがかかったことを検知する。厚みセンサ１９が反応せずに、上電極１７ａ，１７ｂ，１７ｃから出力があった場合には水濡れと定義し、乗員検知判定の材料として用いる。電界式乗員検知センサ１３は水分の検知方法は、上記の第１の実施の形態で説明したと同様に電界式乗員検知センサ１３の上電極と下電極の対地インピーダンスを測定することにより行うことができる。

【００４３】シートに人が座った場合には、厚みセンサ１９が反応する。この場合には上記の第１の実施の形態で示した式（１）、（２）を使用して、エリアの大きさの演算値Ａと距離演算値Ｒを算出し、演算値Ａの最大値Ａｍａｘと平均値Ａａｖｅの関係と、演算値Ａの最大値Ａｍａｘと距離演算値Ｒの最大値Ｒｍａｘの関係をそれぞれ予め制御回路１０に記憶されている大人と子供の判断基準となるしきい値データと比較して大人と子供の判別を行う。

【００４４】次に本発明の第４の実施の形態の乗員検知システムについて図面を参照して説明する。図７は本発明の第４の実施の形態の乗員検知システムの側面図である。

【００４５】本実施の形態の実施例の乗員検知システムは、上記の本発明の第３の実施の形態の乗員検知システム（図５）に、さらに重量センサを付加したものである。図７においては重量センサはシート全体の重量を検知する重量センサの第２の重量センサ１５、シート１の足部分の歪みにより重量を検知する歪みゲージ式重量センサの第３の重量センサ１６の２種類設けられているが、これらのどちらか１種類の重量センサだけを使用してもよい。厚みセンサ１９、各重量センサ１５，１６および電界式乗員検知センサ１３は検知ユニットに接続されている。本実施の形態では、重量センサの設置により上記の第３の実施の形態と比較してシート１への着座の有無の精度を向上できる。

【００４６】本実施の形態の乗員検知センサではシート１の上から重みがかかると絶縁板１３ａが薄くなり上電極１７ａ、１７ｂ、１７ｃが厚みセンサ１９に近づき厚みセンサ１９は上から重みがかかったことを検知する。厚みセンサ１９が反応せずに、上電極１７ａ，１７ｂ，１７ｃから出力があった場合には水濡れと定義し、乗員検知判定の材料として用いる。電界式乗員検知センサ１３は水分の検知方法は、上記の第１の実施の形態で説明したと同様に電界式乗員検知センサ１３の上電極と下電極の対地インピーダンスを測定することにより行うことができる。

【００４７】シート１に人が座った場合には、厚みセンサ１９が反応する。この場合には上記の第１の実施の形態と同様にエリアの大きさの演算値Ａの最大値Ａｍａｘと平均値Ａａｖｅの関係と、エリアの大きさの演算値Ａの最大値Ａｍａｘと距離演算値Ｒの最大値Ｒｍａｘの関係をそれぞれ予め制御回路１０に記憶されている大人と子供の判断基準となるしきい値データと比較して大人と子供の判別を行う。

【００４８】

【発明の効果】以上のように本発明の乗員検知システムでは、絶縁板の上下に弱電界を発生させる電極を配置した電界式乗員検知センサを使用し、隣接する上下電極の３枚のエリアを一区画として上記の式（１）および（２）より各区画の上下電極の出力平均値から物体の大きさを表す演算値Ａとシート上の物体と電界式乗員検知センサとの距離を表す演算値Ｒを計算し、演算値Ａの最大値Ａｍａｘと演算値Ａの平均値Ａａｖｅの関係または演算値Ａの最大値Ａｍａｘと演算値Ｒの最大値Ｒｍａｘの関係を予め前記制御回路に記憶されているしきい値と比較してシートへの乗員の着座有無と乗員の大人・子供の判別が容易に行える。また、絶縁板の上下に弱電界を発生させる電極を配置した電界式乗員検知センサの上下電極の対地インピーダンスの変動大きさを比較することによりシートへの水分の進入の有無が容易に判別できる効果が得られる。

【００４９】さらに本発明の乗員検知システムでは、絶縁板の上下に弱電界を発生させる電極を配置した電界式乗員検知センサと重量センサおよび／または厚みセンサとの組合せにより乗員検知精度をさらに向上できる効果が得られる。

【図面の簡単な説明】

【図１】本発明の第１の実施の形態の乗員検知システムの側面図である。

【図２】図１の乗員検知システムの電界式乗員検知センサの平面図および側面図である。

【図３】本発明の第１の実施の形態の乗員検知システムの電界式乗員検知センサの上電極の他の実施例の平面図である。

【図４】本発明の第２の実施の形態の乗員検知システムの側面図である。

【図５】本発明の第３の実施の形態の乗員検知システムの側面図である。

【図６】図５の乗員検知システムの電界式乗員検知センサの平面図および側面図である。

【図７】本発明の第４の実施の形態の乗員検知システムの側面図である。

【図８】図１の乗員検知システムの回路ブロック図である。

【図９】図４の乗員検知システムの回路ブロック図である。

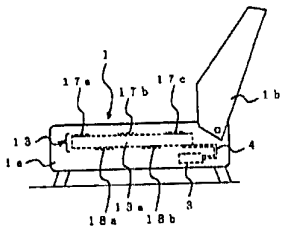
【図１０】従来の乗員検知システムを説明するためのシートの側面図および正面図である。

【図１１】従来の乗員検知システムの回路ブロック図である。

【符号の説明】

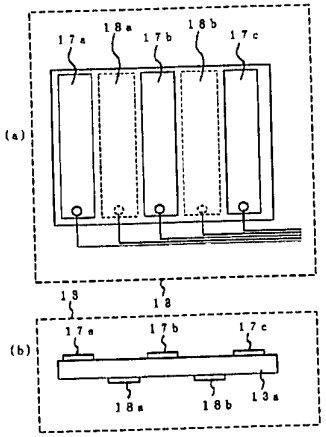
１　シート
１ａ　着席部
１ｂ　背もたれ部
２　アンテナ電極
３　検知ユニット
４　シールド線
５　発振回路
６　電流検出回路
７　スイッチング素子
７ａ～７ｅ　スイッチング手段
８　ＡＣ－ＤＣ変換回路
９　増幅回路
１０　制御回路
１１　コネクタ
１２　エアバッグ装置
１３　電界式乗員検知センサ
１４　第１の重量センサ
１５　第２の重量センサ
１６　第３の重量センサ
１７ａ～１７ｃ　上電極
１８ａ，１８ｂ　下電極
１９　厚みセンサ
２０　ヒダ状電極

【図1】

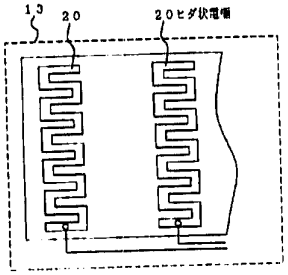


1：シート
1a：着座部
1b：背もたれ部
3：検知ユニット
4：シールド線
13：電界式乗員検知センサ
13a：絶縁板
17a～17c：上電極
18a，18b：下電極

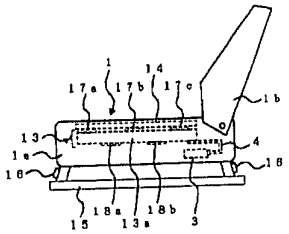
【図2】



【図3】

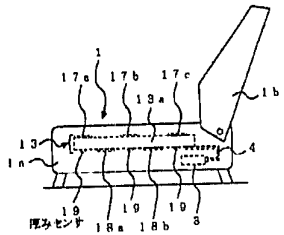


【図4】

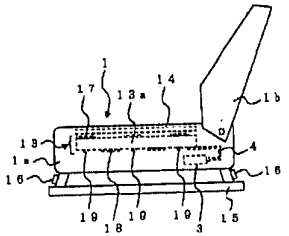


14：第1の重量センサ
15：第2の重量センサ
16：第3の重量センサ

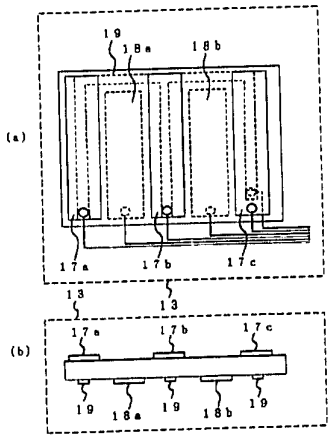
【図5】



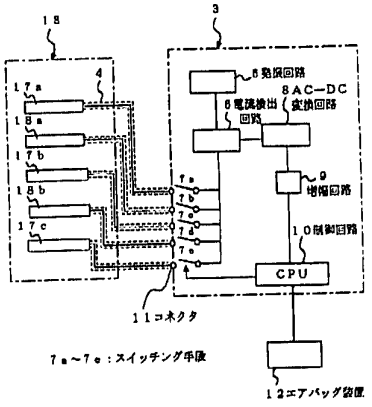
【図7】



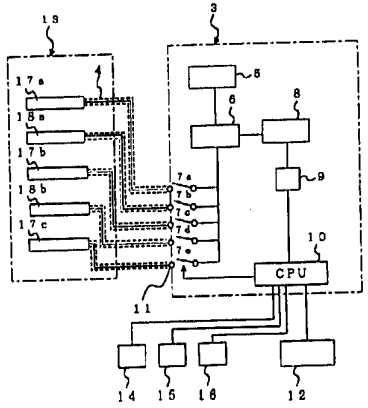
【図6】



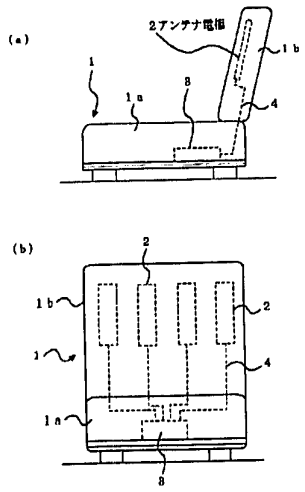
【図8】



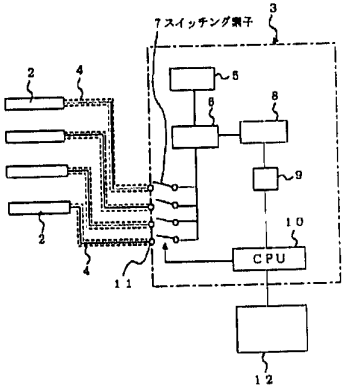
【図9】



【図10】



【図１１】



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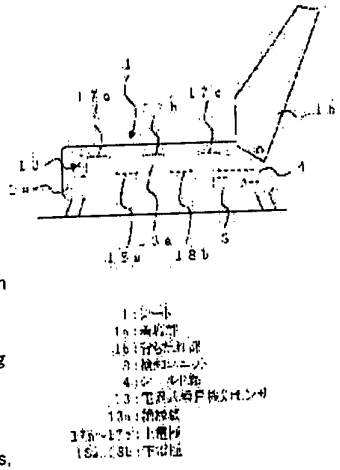
(71)Applicant : NEC CORP
(72)Inventor : OIKAWA HIROSHI

(54) OCCUPANT SENSING SYSTEM AND OCCUPANT DETECTING METHOD BY USING IT

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an occupant sensing system enabling more accurate occupant detection by discriminating between the effects due to wetting and a human body on an electric field-based occupant detection sensor.
SOLUTION: The occupant sensing system is provided with an sheet 1, an electric field-based occupant detection sensor 13 having a seat 1 and both upper electrodes 17a, 17b, 17c and lower electrodes 18a, 18b alternately arranged at regular intervals on upper and lower surfaces of an insulating plate 13a, and a detection unit 3 having an oscillation circuit for generating weak electric field on the upper and lower electrodes, a current detecting circuit to detect a load current flowing to the upper and lower electrodes, a current-voltage conversion circuit to convert a potential current flowing based on the weak electric field into voltage, and a control circuit to detect seating status of the occupants, etc., for the seat 1 based on a signal output from the current detecting circuit and the current-voltage conversion circuit.



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[Patent number]
[Date of registration]
[Number of appeal against examiner's decision

of rejection]
[Date of requesting appeal against examiner's decision of rejection]
[Date of extinction of right]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] It has two or more the 1st electrode and 2nd electrode of the same width of face which have been alternately arranged so that an electrode spacing may become fixed in the field of each upper and lower sides of a sheet and the electric insulating plate of predetermined thickness. The electric-field type crew detection sensor arranged so that said electric insulating plate may become level inside said sheet, The potential current which flows based on the oscillator circuit for making said the 1st electrode and said 2nd electrode generate feeble electric field, the current detector which detects the load current which flows from this oscillator circuit to said 1st and 2nd electrodes, and said feeble electric field is detected. The crew detection system characterized by providing the detection unit which has the control circuit which detects taking-a-seat situations, such as crew to a sheet, based on the current and electrical-potential-difference conversion circuit changed into an electrical potential difference, said current detector, and said current and electrical-potential-difference conversion circuit output signal.
[Claim 2] It has two or more the 1st electrode and 2nd electrode of the same width of face which have been alternately arranged so that an electrode spacing may become fixed in the field of each upper and lower sides of a sheet and the electric insulating plate of predetermined thickness. The electric-field type crew detection sensor arranged so that said electric insulating plate may become level inside said sheet, The weight sensor which detects the weight of the crew who is prepared in the interior and/or the lower part of said sheet, and takes a seat on said sheet, The potential current which flows based on the oscillator circuit for making said the 1st electrode and said 2nd electrode generate feeble electric field, the current detector which detects the load current which flows from this oscillator circuit to said 1st and 2nd electrodes, and said feeble electric field is detected. The crew detection system characterized by providing the detection unit which has the control circuit which detects taking-a-seat situations, such as crew to a sheet, based on the output signal of the current and electrical-potential-difference conversion circuit changed into an electrical potential difference, said current detector, said current and electrical-potential-difference conversion circuit, and said weight sensor.
[Claim 3] It has a thickness sensor on said inferior surface of tongue of two or more 1st electrodes of the same width of face and the 2nd electrode which have been alternately arranged so that an electrode spacing may become fixed in the field of each upper and lower sides of a sheet and the electric insulating plate of predetermined thickness, and said electric insulating plate directly under said 1st electrode. The electric-field type crew detection sensor arranged so that said electric insulating plate may become level inside said sheet, The potential current which flows based on the oscillator circuit for making said the 1st electrode and said 2nd electrode generate feeble electric field, the current detector which detects the load current which flows from this oscillator circuit to said 1st and 2nd electrodes, and said feeble electric field is detected. The crew detection system characterized by providing the detection unit which has the control circuit which detects taking-a-seat situations, such as crew to a sheet, based on the output signal of the current and electrical-potential-difference conversion circuit changed into an electrical potential difference, said current detector, said current and electrical-potential-difference conversion circuit, and said thickness sensor.

[Claim 4] It has a thickness sensor on said inferior surface of tongue of two or more 1st electrodes of the same width of face and the 2nd electrode which have been alternately arranged so that an electrode spacing may become fixed in the field of each upper and lower sides of a sheet and the electric insulating plate of predetermined thickness, and said electric insulating plate directly under said 1st electrode. The electric-field type crew detection sensor arranged so that said electric insulating plate may become level inside said sheet, The weight sensor which detects the weight of the crew who is prepared in the interior and/or the lower part of said sheet, and takes a seat on said sheet, The potential current which flows based on the oscillator circuit for making said the 1st electrode and said 2nd electrode generate feeble electric field, the current detector which detects the load current which flows from this oscillator circuit to said 1st and 2nd electrodes, and said feeble electric field is detected. The current and electrical-potential-difference conversion circuit changed into an electrical potential difference, said current detector, said current and electrical-potential-difference conversion circuit, and said thickness sensor.
[Claim 5] The crew detection system according to claim 2 or 4 characterized by said weight sensor formed in the interior of said sheet consisting of the 1st mat-type weight sensor.
[Claim 6] The crew detection system according to claim 2 or 4 characterized by said weight sensor formed in the lower part of said sheet consisting of the 2nd strain gage-type weight sensor prepared in the foot of said sheet.
[Claim 7] The crew detection system according to claim 2 or 4 characterized by said weight sensor formed in the lower part of said sheet consisting of the 3rd weight sensor which can measure the weight of the body by which said whole sheet is laid and a load is carried out on this whole sheet and this sheet.
[Claim 8] The crew detection system according to claim 2 or 4 characterized by said weight sensor formed in the lower part of said sheet consisting of said 2nd weight sensor according to claim 6 and the 3rd weight sensor according to claim 7.
[Claim 9] The crew detection system according to claim 1 to 4 characterized by said the 1st electrode and said 2nd electrode being a rectangle-like.
[Claim 10] The crew detection system according to claim 1 to 4 characterized by said 1st electrode being HIDA-like.
[Claim 11] The crew detection system according to claim 3 or 4 characterized by using soft-elastic resin as said electric insulating plate of said electric-field type crew detection sensor.
[Claim 12] Are the crew detection approach which used the crew detection system according to claim 1 to 4, and area of three sheets of said 1st adjoining electrode and said 2nd electrode to occupy is considered as one partition. The average of the magnitude of the direct current which was outputted from said 1st electrode which generates said feeble electric field, and was changed by said current and electrical-potential-difference conversion circuit T, The average of the magnitude of the direct current which was outputted from said 2nd electrode which generates said feeble electric field, and was changed by said current and electrical-potential-difference conversion circuit is set to B. The operation value R showing the distance of the operation value A showing the magnitude of the body on said sheet defined by a bottom type (1) and (2), this body on said sheet, and said electric-field type crew detection sensor is calculated for every partition. The relation between the maximum Amax of the operation value A and the average Aave of the operation value A or the relation between the maximum Amax of the operation value A and the maximum Rmax of the operation value R is compared with the threshold memorized beforehand in said control circuit. The crew detection approach characterized by distinguishing adult and child of the taking-a-seat existence of the crew to said sheet, and crew.
[Equation 1]

$$A = \frac{T*B}{(T-B)} * B^{-\gamma} \quad (1)$$

$$R = \frac{A*Z}{T} \quad (2)$$

但し、γ：定数，Z：定数

[Claim 13] The crew detection approach characterized by comparing the magnitude of fluctuation of the airraid impedance of said 1st electrode of said electric-field type crew detection sensor, and said 2nd electrode further, and distinguishing adult and child of the existence of the moisture penetration to said sheet, the taking-a-seat existence of the crew to said sheet, and crew in the crew detection approach according to claim 13.

[Claim 14] The crew detection approach characterized by to compare the magnitude of fluctuation of the airraid impedance of said 1st electrode of the magnitude of the output of said weight sensor which is the crew detection approach which used the crew detection system according to claim 2, and was formed in the interior and/or the lower part of said sheet, and said electric-field type crew detection sensor, and said 2nd electrode, and to distinguish the taking-a-seat existence of the crew to said sheet, and the existence of the moisture penetration to said sheet.

[Claim 15] The crew detection approach which is the crew detection approach which used the crew detection system according to claim 3, and is characterized by comparing the magnitude of fluctuation of the airraid impedance of said 1st electrode of the magnitude of the output of said thickness sensor, and said electric-field type crew detection sensor, and said 2nd electrode, and distinguishing the taking-a-seat existence of the crew to said sheet, and the existence of the moisture penetration to said sheet.

[Claim 16] It is the crew detection approach which used the crew detection system according to claim 4. The magnitude of the output of said thickness sensor, The magnitude of fluctuation of the airraid impedance of said 1st electrode of the magnitude of the output of said weight sensor formed in the interior and/or the lower part of said sheet and said electric-field type crew detection sensor and said 2nd electrode is compared. The crew detection approach characterized by distinguishing the taking-a-seat existence of the crew to said sheet, and the existence of the moisture penetration to said sheet.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] Especially this invention relates to the improvement in precision of the crew detection system used in order to set it as the condition which can develop the air bag of crew detection system air bag equipment, or the condition which cannot be developed about a crew detection system according to crew's taking-a-seat situation in the car sheet carrying air bag equipment.
[0002]
[Description of the Prior Art] As for the air bag equipment which eases the impact crew is shocked at the time of the collision of an automobile, when an automobile collides regardless of the existence of taking a seat of the crew to a sheet, it is usual that an air bag develops. Such air bag equipment can expect crew's protective effect at the time of the collision of an automobile, when the adult has taken a seat with the normal posture on the sheet, but the crew who has taken a seat on the sheet is a child etc., and when a taking-a-seat posture is unsuitable to air bag expansion, even if an automobile collides, it will be desirable not to develop an air bag.
[0003] then, the existence of taking a seat of the crew to the sheet of the automobile carrying air bag equipment and the crew who took a seat on the sheet -- an adult or a child -- or the crew detection system which detects taking-a-seat situations, such as a posture of the crew who took a seat on the sheet, is proposed by a publication-number No. 236269 [ten to] official report, JP,11-334451,A, etc. An example of this crew detection system is explained with reference to the crew detecting circuit block of the sheet structure of drawing 10 , and drawing 11 . Drawing 10 (a) is the side elevation of a sheet, and drawing 10 (b) is the front view seen from the taking-a-seat section of a sheet. A sign 1 shows a sheet among drawing 10 . This sheet 1 consists of taking-a-seat section 1a and back board section 1b. Taking-a-seat section 1a and back board section 1b consist of sheathing materials which cover the housing which is not illustrated, a cushioning material, and a cushioning material. In the sheet 1 of drawing 1010 , for example between the sheathing material of back board section 1b, and the cushioning material, two or more antenna electrodes 2 are arranged, and the detection unit 3 is installed near the taking-a-seat section 1a. Each antenna electrode 2 and the detection unit 3 are wired with shielding wire 4. Especially the antenna electrode 2 consists of conductors of the shape for example, of a rectangle. In addition, the back also hangs down two or more antenna electrodes 2, and they can also be arranged in the level condition to section 1b in a lengthwise direction.
[0004] The detection unit 3 detects crew's taking-a-seat situation in a sheet 1 based on the information relevant to the current which flows by the feeble electric field generated around the antenna electrode 2. The circuit block diagram of a crew detection system is shown in drawing 11 R> 1. The detection unit 3 For example, an electric-field generating means for an electrical potential difference to generate the RF low battery which is about number -10V in about 120kHz, and for a frequency generate feeble electric field around the antenna electrode 2 (for example, oscillator circuit 5), The information detector which detects the information relevant to the current which flows to the antenna electrode 2 based on the sending signal from an oscillator circuit 5 (for example, current detector 6), Two or more switching elements 7 which transmit the sending signal of an oscillator circuit 5 to each antenna electrode 2 in order, The

AC-DC conversion circuit 8 which changes into a direct current the current detected in the current detector 6, It consists of an amplifying circuit 9 which amplifies the conversion signal if needed, a control circuit 10 containing CPU, the A/D-conversion section, external memory (for example, EEPROM, RAM), etc., and a power circuit which is not illustrated. In this detection unit 3, on-off control of two or more switching elements 7 is carried out based on the signal from a control circuit 10. And each switching element 7 is connected with each antenna electrode 2 by shielding wire 4 through the connector 11. It connects with air bag equipment 12, and a control circuit 10 is controlled to mention air bag equipment 12 later.
[0005] It is transmitted to a switching element 7 through the current detector 6, and the sending signal from an oscillator circuit 5 is impressed to the specific antenna electrode 2 through the shielding wire 4 which corresponds if the specific switching element 7 turns on, and generates feeble electric field around the specific antenna electrode 2. To the antenna electrode 2 which feeble electric field generated, the current according to the taking-a-seat situation of the crew to a sheet 1 flows. This current is detected in the current detector 6. By carrying out on-off control of two or more switching elements 7 to order, the current which flows to each antenna electrode 2 is detected one after another. These detection currents are changed into a direct current by the AC-DC conversion circuit 8, are amplified in an amplifying circuit 9, and are incorporated in a control circuit 10.
[0006] In the control circuit 10, threshold data, signal pattern data, etc. which serve as a decision criterion of crew's taking-a-seat situation beforehand are memorized, the actual signal data by which data processing was incorporated and carried out in the control circuit 10 are compared with threshold data, and the taking-a-seat situation (the existence of taking a seat and crew are an adult, a child, etc.) of the crew to a sheet 1 is judged. This decision result is transmitted to air bag equipment 12 from a control circuit 10, and the air bag of air bag equipment 12 is set to the condition which can be developed, or the condition which cannot be developed.
[0007]
[Problem(s) to be Solved by the Invention] In the conventional crew detection system which used the sensor of the antenna electrode 2 with which each above electrode is constituted on the same flat surface, it is detected by the same level in the condition that the person big, for example is sitting down on the sheet, putting down a floor cushion, and the condition that a direct seat is without a small man putting down a floor cushion on a sheet. Moreover, the effect on the detection sensibility by the thickness of people's clothes was nonavoidable. Moreover, since the specific inductive capacity which the body has was the electric-field type crew detection system characterized by differing from other bodies greatly, when the moisture which has the specific inductive capacity near the body on a sheathing material and the components which constitute between two or more antenna electrodes 2 advanced, the effect of moisture and a man carving was not completed.
[0008] Therefore, the purpose of this invention does not have the effect of the floor cushion existence on a sheet, can perform distinction with penetration and the body of moisture, and is to offer the crew detection system which can moreover expect sufficient crew detection precision.
[0009]
[Means for Solving the Problem] The 1st configuration of this invention is a crew detection system, and it has two or more the 1st electrode and 2nd electrode of the same width of face which have been alternately arranged so that an electrode spacing may become fixed in the field of each upper and lower sides of a sheet and the electric insulating plate of predetermined thickness. The electric-field type crew detection sensor arranged so that said electric insulating plate may become level inside said sheet, The potential current which flows based on the oscillator circuit for making said the 1st electrode and said 2nd electrode generate feeble electric field, the current detector which detects the load current which flows from this oscillator circuit to said 1st and 2nd electrodes, and said feeble electric field is detected. It is characterized by providing the detection unit which has the control circuit which detects taking-a-seat situations, such as crew to a sheet, based on the current and electrical-potential-

difference conversion circuit changed into an electrical potential difference, said current detector, and said current and electrical-potential-difference conversion circuit output signal.
[0010] The 2nd configuration of this invention is a crew detection system, and it has two or more the 1st electrode and 2nd electrode of the same width of face which have been alternately arranged so that an electrode spacing may become fixed in the field of each upper and lower sides of a sheet and the electric insulating plate of predetermined thickness. The electric-field type crew detection sensor arranged so that said electric insulating plate may become level inside said sheet, The weight sensor which detects the weight of the crew who is prepared in the interior and/or the lower part of said sheet, and takes a seat on said sheet, The potential current which flows based on the oscillator circuit for making said the 1st electrode and said 2nd electrode generate feeble electric field, the current detector which detects the load current which flows from this oscillator circuit to said 1st and 2nd electrodes, and said feeble electric field is detected. It is characterized by providing the detection unit which has the control circuit which detects taking-a-seat situations, such as crew to a sheet, based on the output signal of the current and electrical-potential-difference conversion circuit changed into an electrical potential difference, said current detector, said current and electrical-potential-difference conversion circuit, and said weight sensor.
[0011] The 3rd configuration of this invention is a crew detection system. A sheet, It has a thickness sensor on said inferior surface of tongue of two or more 1st electrodes of the same width of face and the 2nd electrode which have been alternately arranged so that an electrode spacing may become fixed in the field of each upper and lower sides of the electric insulating plate of predetermined thickness, and said electric insulating plate directly under said 1st electrode. The electric-field type crew detection sensor arranged so that said electric insulating plate may become level inside said sheet, The potential current which flows based on the oscillator circuit for making said the 1st electrode and said 2nd electrode generate feeble electric field, the current detector which detects the load current which flows from this oscillator circuit to said 1st and 2nd electrodes, and said feeble electric field is detected. It is characterized by providing the detection unit which has the control circuit which detects taking-a-seat situations, such as crew to a sheet, based on the output signal of the current and electrical-potential-difference conversion circuit changed into an electrical potential difference, said current detector, said current and electrical-potential-difference conversion circuit, and said thickness sensor.
[0012] The 4th configuration of this invention is a crew detection system. A sheet, It has a thickness sensor on said inferior surface of tongue of two or more 1st electrodes of the same width of face and the 2nd electrode which have been alternately arranged so that an electrode spacing may become fixed in the field of each upper and lower sides of the electric insulating plate of predetermined thickness, and said electric insulating plate directly under said 1st electrode. The electric-field type crew detection sensor arranged so that said electric insulating plate may become level inside said sheet, The weight sensor which detects the weight of the crew who is prepared in the interior and/or the lower part of said sheet, and takes a seat on said sheet, The potential current which flows based on the oscillator circuit for making said the 1st electrode and said 2nd electrode generate feeble electric field, the current detector which detects the load current which flows from this oscillator circuit to said 1st and 2nd electrodes, and said feeble electric field is detected. It is characterized by providing the detection unit which has the control circuit which detects taking-a-seat situations, such as crew to a sheet, based on the output signal of the current and electrical-potential-difference conversion circuit changed into an electrical potential difference, said current detector, said current and electrical-potential-difference conversion circuit, said thickness sensor, and said weight sensor.
[0013] The electrode of the shape of a rectangle or HIDA can be used as said 1st electrode of said electric-field type sensor in the crew detection system of the 1st - the 4th configuration of above-mentioned this invention.
[0014] In the crew detection system of the 2nd and the 4th configuration of above-mentioned this invention, a mat type weight sensor can be used as said weight sensor formed in the interior of said sheet. Moreover, the whole strain gage type weight sensor aforementioned sheet

prepared in the foot of an account sheet as said weight sensor formed in the lower part of said sheet is laid, and the weight sensor which can measure the weight of this whole sheet can be used.
[0015] The 5th configuration of this invention is the crew detection approach which used the crew detection system of the 1st - one of the 4th above-mentioned configurations. Are the crew detection approach which used the crew detection system according to claim 1 to 4, and area of three sheets of said 1st adjoining electrode and said 2nd electrode to occupy is considered as one partition. The average of the magnitude of the direct current which was outputted from said 1st electrode which generates said feeble electric field, and was changed by said current and electrical-potential-difference conversion circuit T, The average of the magnitude of the direct current which was outputted from said 2nd electrode which generates said feeble electric field, and was changed by said current and electrical-potential-difference conversion circuit is set to B. The operation value R showing the distance of the operation value A showing the magnitude of the body on said sheet defined by a bottom type (1) and (2), this body on said sheet, and said electric-field type crew detection sensor is calculated for every partition. The relation between the maximum Amax of the operation value A and the average Aave of the operation value A or the relation between the maximum Amax of the operation value A and the maximum Rmax of the operation value R is compared with the threshold memorized beforehand in said control circuit. It is characterized by judging adult and child of the taking-a-seat existence of the crew to said sheet, and crew.
[0016]
[Equation 2]

$$A = \frac{T * B}{(T - B)} * B^{-\gamma} \quad (1)$$

$$R = \frac{A * Z}{T} \quad (2)$$

但し、y：定数，Z：定数

[0017] The 6th configuration of this invention is the crew detection approach which used the above-mentioned crew detection system of the 1st - the 4th configuration, detects the magnitude of fluctuation of the airraid impedance of said 1st electrode and said 2nd electrode further to the crew detection approach of the above-mentioned configuration of the 5th, and is characterized by to perform distinction of the existence and adult, and child of the existence of the moisture penetration to said sheet, and the crew seat to said sheet.
[0018] The 7th configuration of this invention is the crew detection approach which used the crew detection system of the above-mentioned configuration of the 2nd. The magnitude of fluctuation of the airraid impedance of said 1st electrode of the magnitude of the output of said weight sensor formed in the interior and/or the lower part of said sheet and said electric-field type crew detection sensor and said 2nd electrode is compared. It is characterized by distinguishing the taking-a-seat existence of the crew to said sheet, and the existence of the moisture penetration to said sheet.
[0019] The 8th configuration of this invention is the crew detection approach which used the crew detection system of the above-mentioned configuration of the 3rd, and is characterized by comparing the magnitude of fluctuation of the airraid impedance of said 1st electrode of the magnitude of the output of said thickness sensor, and said electric-field type crew detection sensor, and said 2nd electrode, and distinguishing the taking-a-seat existence of the crew to said sheet, and the existence of the moisture penetration to said sheet.
[0020] The 9th configuration of this invention is the crew detection approach which used the crew detection system of the above-mentioned configuration of the 4th. The magnitude of the output of said thickness sensor, The magnitude of fluctuation of the airraid impedance of said 1st electrode of the magnitude of the output of said weight sensor formed in the interior and/or the lower part of said sheet and said electric-field type crew detection sensor and said 2nd electrode is compared. It is characterized by distinguishing the taking-a-seat existence of the crew to said sheet, and the existence of the moisture penetration to said sheet.

[0021]
[Embodiment of the Invention] Next, a drawing is made reference about the crew detection system of the gestalt of operation of this invention, and it explains to a detail.
[0022] Drawing 1 is the side elevation of the crew detection system of the gestalt of operation of the 1st of this invention. Like drawing 1 , the crew detection system of the gestalt of this operation It has two or more upper electrodes 17a, 17b, and 17c (the 1st electrode) of the same width of face alternately arranged so that an electrode spacing may become fixed in the field of each upper and lower sides of a sheet 1 and electric insulating plate 13a of predetermined thickness, and the bottom electrodes 18a and 18b (the 2nd electrode). The electric-field type crew detection sensor 13 arranged so that this electric insulating plate may become level to the sheet 1 interior, The current detector and the upper electrodes 17a, 17b, and 17c which detect the load current which flows to the electrode of the upper electrodes 17a, 17b, and 17c and the bottom electrodes 18a and 18b from the oscillator circuit and this oscillator circuit for generating feeble electric field between the upper electrodes 17 and/or between the bottom electrodes 18, The potential current which flows based on the feeble electric field of the bottom electrodes 18a and 18b is detected, and the detection unit 3 which has the control circuit which detects taking-a-seat situations, such as crew to a sheet, based on the current and the electrical-potential-difference conversion circuit, current detector, and the current and the electrical-potential-difference conversion circuit output signal which are changed into an electrical potential difference is provided.
[0023] The detection unit 3 is connected to the electric-field type crew detection sensor 13 through shielding wire 4. In addition, the back also gives sign 1in drawing 1 b, and it shows the section.
[0024] Drawing 2 is the top view (drawing 2 (a)) and sectional view (drawing 2 (b)) of the electric-field type crew detection sensor 13 of drawing 1 . As electric insulating plate 13a, electric insulating plates, such as an epoxy resin, polyimide resin, and polyurethane resin, can be used. The upper electrode of the electric-field type crew detection sensor 13 and a bottom electrode etch copper foil, and are formed. It is desirable to perform anticorrosion processing to the front face of these electrodes by nickel plating, gilding, etc. Like drawing 2 , the vertical electrode of the electric-field type crew detection sensor 13 was shifted alternately, and it arranges for preventing interference of a vertical electrode.
[0025] In addition, a rectangle-like electrode like drawing 2 as a configuration of an upper electrode and a HIDA-like electrode 20 like drawing 3 can be used. In the case of the HIDA-like electrode 20 of drawing 3 , the area of an electrode side face can increase, and the effect sensibility to the inter-electrode insulation by the moisture which stuck to inter-electrode can be improved in it.
[0026] Drawing 8 is the circuit block diagram of the crew detection system of drawing 1 . As for the sign 5 of the detection unit 3 section, an oscillator circuit and 6 are the connectors by which a current detector, and 7a-7e were prepared in the switching means, and 8 was prepared in the detection unit to connect an amplifying circuit and 10 to a control circuit by the seal line 4, and for an AC-DC conversion circuit and 9 connect the upper electrodes 17a, 17b, and 17c of the electric-field type crew detection sensor 13, and the bottom electrodes 18a and 18b to a detection unit, as for a sign 11 among drawing. Moreover, a sign 12 shows the air bag equipment by which it connects with a control circuit and the actuation (un-developing [expansion,]) is controlled.
[0027] Next, actuation of this crew detection system is explained with reference to drawing 1 and drawing 8 . First, only switching means 7a is closed based on the signal from a control circuit 10, and Kaisei of the other switching means 7b-7e is carried out. For this reason, a gate signal is given to the switching means (it is not displaying) of the oscillator circuit 5 of an electric-field generating means. If a gate signal becomes yes (High), it will become ON, the drain of that will serve as touch-down level, and the switching means of an oscillator circuit 5 will not be outputted to a transmitting system each time. In addition, the charge charged by the capacitance component which exists around upper electrode 17a in this case discharges through the switching means of an oscillator circuit 5.

[0028] On the other hand, if a gate signal serves as a low (Low), the switching means of an oscillator circuit 5 will become off, and a RF low battery (for example, 120kHz, +5V) will be outputted to a transmitting system. This RF output is supplied to upper electrode 17a through a transmitting system and a connector 11, and feeble electric field are generated around upper electrode 17a. Consequently, the current of different level according to taking-a-seat situations, such as existence of taking a seat of the crew to a sheet 1 and discernment (distinction of an adult or a child) of crew, flows.
[0029] Thus, in the current detector 6, impedance conversion of a transmitting system and the RF low battery (voltage waveform) of upper electrode 17a including an oscillator circuit 5 (electric-field generating means) is carried out. That is, an input side serves as a high impedance, an output side (AC-DC conversion circuit 8 side) serves as low impedance, and it becomes possible to incorporate suitably the current which reading of a control circuit 10 takes if needed.
[0030] The output (RF low battery) of the current detector 6 is inputted into the AC-DC conversion circuit 8. In this circuit 8, smooth [of the Rhine electrical potential difference of an alternating current] is carried out by the smoothing circuit containing resistance and a capacitor, and it is changed into a direct current. A/D conversion of the dc output of this AC-DC conversion circuit 8 is incorporated and carried out to a control circuit 10 via an amplifying circuit 9, and it is stored in memory. And switching means 7from switching means 7a b ... Whenever it is switched to switching means 7e, the signal relevant to each polar zone (the upper electrodes 17b and 17c, bottom electrodes 18a and 18b) is outputted from each interface circuitry, and is incorporated one after another in a control circuit 10.
[0031] The operation value A of the magnitude of area and the distance operation value R are calculated from a degree type (1) and (2), using the output value (average) of T and a bottom electrode as B for the output value (average) of the upper electrode of the area of three vertical electrodes (for example, upper electrode 17a, bottom electrode 18a, upper electrode 17b) which adjoin now.
[0032]
[Equation 3]

$$A = \frac{T * B}{(T - B)} * B^{-y} \quad (1)$$

$$R = \frac{A * Z}{T} \quad (2)$$

但し、y：定数，Z：定数

[0033] An adult's output value of each electrode is large, and a child tends to become small. Moreover, when the body of the same magnitude also has a near distance with a sensor, it is large, and it becomes small when far. This inclination is used and an adult and a child are distinguished as compared with the threshold data (it memorizes beforehand in the control circuit 1) which serve as a decision criterion, respectively in the maximum Amax of the maximum Amax of the value of A of each area, and the value of the comparison of the average Aave, and A of each area, and the maximum Rmax of the distance operation value R of each area.
[0034] In the crew detection system of the gestalt of the 1st operation of the above, the existence of penetration of the water to a sheet can be judged by measuring the magnitude of the airraid impedance of the upper electrodes 17a, 17b, and 17c of the electric-field type crew detection sensor 13, and the bottom electrodes 18a and 18b. Since the airraid impedance of an upper electrode will be sharply changed as compared with a bottom electrode if water advances, ****** is known.
[0035] In addition, changing into the expansion of air bag equipment 12 or the condition which can be un-developed shown in drawing 8 as compared with the threshold data memorized beforehand is determined as a control circuit the relation between the above-mentioned maximum Amax and the average Aave, and Maximum Amax and maximum Rmax-related.
[0036] Next, the crew detection system of the gestalt of operation of the 2nd of this invention is explained with reference to a drawing. Drawing 4 is the side elevation of the crew detection

system of the gestalt of operation of the 2nd of this invention. The same sign as drawing 1 expresses the same thing as drawing 1 with drawing 4 .

[0037] The crew detection system of the gestalt of this operation adds a weight sensor to the crew detection system of the gestalt of operation of the 1st of above-mentioned this invention further. In drawing 4 A ****** sensor, for example by distortion for a foot [sheet / 1 / the 1st weight sensor 14 of a mat type weight sensor and the 2nd weight sensor 15 of the weight sensor which detects the weight of the whole sheet which were formed on the electric-field type crew detection sensor 13 inside a sheet, and] Although three kinds of 3rd weight sensor 16 of the strain gage type weight sensor which detects weight is formed, one kind or two kinds of these weight sensors may be used. The electric-field type crew detection sensor 13 is connected to the detection unit 3 through shielding wire 4. Moreover, each weight sensor is also connected to the detection unit 3. Drawing 9 is the circuit block diagram of the crew detection system of drawing 4 . Like drawing 9 , it connects with the control circuit 10 of the detection unit 3, and each weight sensor detects the output signal of a weight sensor.

[0038] The detection unit 3 of the crew detection system of the gestalt of this operation and the electric-field type crew detection sensor 13 carry out the same actuation as the gestalt of the 1st operation of the above. Furthermore with the gestalt of this operation, penetration of the water to a sheet is detectable by installing a weight sensor like drawing 4 . the threshold data used as the decision criterion beforehand memorized like the gestalt of the 1st operation of the above in the control circuit 10, respectively in the maximum Amax of the operation value A of the magnitude of area, the relation of the average Aave, and the relation between the maximum Amax of the operation value A of the magnitude of area, and the maximum Rmax of the distance operation value R when a weight sensor detects a body -- comparing -- an adult and a child -- distinguishing .

[0039] In the crew detection system of the gestalt of this operation, when it gets wet bywater, and when the body has not ridden on the seat, the electric-field type crew detection sensor 13 detects moisture, but since the weight sensors 14, 15, and 16 all are not influenced of moisture, they are not detected as a body. When applied to this condition, it is judged with a ****** condition. The electric-field type crew detection sensor 13 can perform the detection approach of moisture by measuring the airraid impedance of the upper electrode of the electric-field type crew detection sensor 13, and a bottom electrode similarly with the gestalt of the 1st operation of the above having explained.

[0040] Next, the crew detection system of the gestalt of operation of the 3rd of this invention is explained with reference to a drawing. Drawing 5 is the side elevation of the crew detection system of the gestalt of operation of the 3rd of this invention, and drawing 6 is the top view (drawing 6 (a)) and sectional view (drawing 6 (b)) of an electric-field type crew detection sensor.

[0041] The crew detection system of the example of the gestalt of this operation adds the thickness sensor 19 to each upper electrodes 17a and 17b of the electric-field type crew detection sensor 13 of the crew detection system of the gestalt of operation of the 1st of above-mentioned this invention, and the inferior surface of tongue of electric insulating plate 13a of a 17c directly under further. It connects with the control circuit 10 of the same detection unit shown in drawing 7 , and this thickness sensor 19 detects the output signal of the thickness sensor 19.

[0042] Soft-elastic resin, such as polyurethane, is used for electric insulating plate 13a of the electric-field type crew detection sensor 13. It detects that became thin, the upper electrode approached the thickness sensor 19, and the thickness sensor 19 required weight from the top as electric insulating plate 13a which consists of this soft-elastic resin requiring weight from a top. When there is an output from the upper electrodes 17a, 17b, and 17c, without the thickness sensor 19 reacting, it is defined as ******, and it uses as an ingredient of a crew detection judging. The electric-field type crew detection sensor 13 can perform the detection approach of moisture by measuring the airraid impedance of the upper electrode of the electric-field type crew detection sensor 13, and a bottom electrode similarly with the gestalt of the 1st operation of the above having explained.

[0043] When people sit on a sheet, the thickness sensor 19 reacts. In this case, the formula (1) shown with the gestalt of the 1st operation of the above and (2) are used. The operation value A of the magnitude of area and the distance operation value R are computed. The maximum Amax of the operation value A, and the relation of the average Aave, Distinction of an adult and a child is performed as compared with the threshold data used as the adult beforehand memorized in the control circuit 10, respectively in the relation between the maximum Amax of the operation value A, and the maximum Rmax of the distance operation value R, and a child's decision criterion.

[0044] Next, the crew detection system of the gestalt of operation of the 4th of this invention is explained with reference to a drawing. Drawing 7 is the side elevation of the crew detection system of the gestalt of operation of the 4th of this invention.

[0045] The crew detection system of the example of the gestalt of this operation adds a weight sensor to the crew detection system (drawing 5) of the gestalt of operation of the 3rd of above-mentioned this invention further. Although the 2nd weight sensor 15 of the weight sensor by which a weight sensor detects the weight of the whole sheet, and two kinds of 3rd weight sensor 16 of the strain gage type weight sensor which detects weight by distortion for a foot [sheet / 1] are formed in drawing 7 , only one kind of these ones of weight sensors may be used. The thickness sensor 19, each weight sensors 15 and 16, and the electric-field type crew detection sensor 13 are connected to the detection unit. With the gestalt of this operation, the precision of the existence of taking a seat to a sheet 1 can be improved by installation of a weight sensor as compared with the gestalt of the 3rd operation of the above.

[0046] By the crew detection sensor of the gestalt of this operation, it detects that electric insulating plate 13a became it thin that weight was applied from on a sheet 1, the upper electrodes 17a, 17b, and 17c approached the thickness sensor 19, and the thickness sensor 19 required weight from the top. When there is an output from the upper electrodes 17a, 17b, and 17c, without the thickness sensor 19 reacting, it is defined as ******, and it uses as an ingredient of a crew detection judging. The electric-field type crew detection sensor 13 can perform the detection approach of moisture by measuring the airraid impedance of the upper electrode of the electric-field type crew detection sensor 13, and a bottom electrode similarly with the gestalt of the 1st operation of the above having explained.

[0047] When people sit on a sheet 1, the thickness sensor 19 reacts. In this case, distinction of an adult and a child is performed as compared with the threshold data used as the adult beforehand memorized like the gestalt of the 1st operation of the above in the control circuit 10, respectively in the maximum Amax of the operation value A of the magnitude of area, the relation of the average Aave, and the relation between the maximum Amax of the operation value A of the magnitude of area, and the maximum Rmax of the distance operation value R, and a child's decision criterion.

[0048]

[Effect of the Invention] As mentioned above in the crew detection system of this invention The electric-field type crew detection sensor which has arranged the electrode of an electric insulating plate made to generate a weak-electric-current community up and down is used. The operation value R showing the distance of the operation value A which expresses objective magnitude from the output average of the vertical electrode of each partition from the above-mentioned formula (1) and (2) by making area of three sheets of an adjoining vertical electrode into a lot, the body on a sheet, and an electric-field type crew detection sensor is calculated. As compared with the threshold beforehand memorized in said control circuit in the relation between the maximum Amax of the operation value A, and the average Aave of the operation value A, or the relation between the maximum Amax of the operation value A, and the maximum Rmax of the operation value R, adult and child of the taking-a-seat existence of the crew to a sheet and crew can be distinguished easily. Moreover, the effectiveness which the existence of penetration of the moisture to a sheet can distinguish easily is acquired by comparing the fluctuation magnitude of the airraid impedance of the vertical electrode of the electric-field type crew detection sensor which has arranged the electrode of an electric insulating plate made to generate a weak-electric-current community up and down.

[0049] Furthermore in the crew detection system of this invention, the effectiveness which can improve crew detection precision further with combination with the electric-field type crew detection sensor, weight sensor, and/or thickness sensor which have arranged the electrode of an electric insulating plate made to generate a weak-electric-current community up and down is acquired.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the side elevation of the crew detection system of the gestalt of operation of the 1st of this invention.
[Drawing 2] It is the top view and side elevation of an electric-field type crew detection sensor of drawing 1 . [of a crew detection system]
[Drawing 3] It is the top view of other examples of the upper electrode of the electric-field type crew detection sensor of the crew detection system of the gestalt of operation of the 1st of this invention.
[Drawing 4] It is the side elevation of the crew detection system of the gestalt of operation of the 2nd of this invention.
[Drawing 5] It is the side elevation of the crew detection system of the gestalt of operation of the 3rd of this invention.
[Drawing 6] It is the top view and side elevation of an electric-field type crew detection sensor of drawing 5 . [of a crew detection system]
[Drawing 7] It is the side elevation of the crew detection system of the gestalt of operation of the 4th of this invention.
[Drawing 8] It is the circuit block diagram of the crew detection system of drawing 1 .
[Drawing 9] It is the circuit block diagram of the crew detection system of drawing 4 .
[Drawing 10] It is the side elevation and front view of a sheet for explaining the conventional crew detection system.
[Drawing 11] It is the circuit block diagram of the conventional crew detection system.
[Description of Notations]
1 Sheet
1a Taking-a-seat section
1b Back board section
2 Antenna Electrode
3 Detection Unit
4 Shielding Wire
5 Oscillator Circuit
6 Current Detector
7 Switching Element
7a-7e Switching means
8 AC-DC Conversion Circuit
9 Amplifying Circuit
10 Control Circuit
11 Connector
12 Air Bag Equipment
13 Electric-Field Type Crew Detection Sensor
14 1st Weight Sensor
15 2nd Weight Sensor
16 3rd Weight Sensor

17a-17c Top electrode
18a, 18b Bottom electrode
19 Thickness Sensor
20 HIDA-like Electrode

[Translation done.]